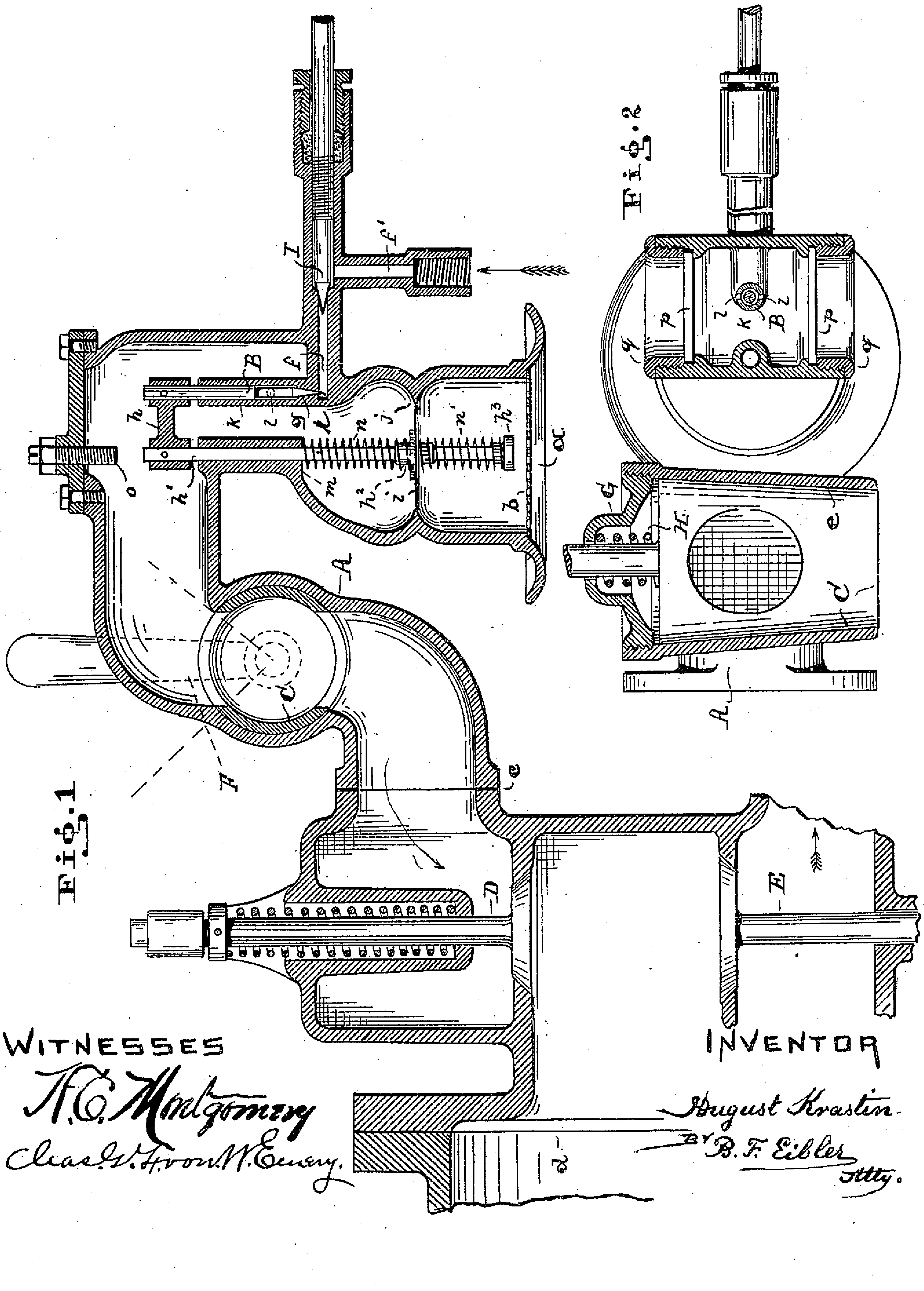
No. 687,840. Patented Dec. 3, 1901.

A. KRASTIN.

FUEL MIXING AND CHARGE CONTROLLING APPARATUS FOR HYDROCARBON EXPLOSIVE ENGINES.

(Application filed June 8, 1900.)

(No Model.)



WITNESSES

H. C. Montgomery

Chas. G. Hron W. Emery.

INVENTOR

August Krastin.

BY B. F. Eibler

Atty.

UNITED STATES PATENT OFFICE.

AUGUST KRASTIN, OF CLEVELAND, OHIO.

FUEL-MIXING AND CHARGE-CONTROLLING APPARATUS FOR HYDROCARBON EXPLOSIVE-ENGINES.

SPECIFICATION forming part of Letters Patent No. 687,840, dated December 3, 1901.

Application filed June 8, 1900. Serial No. 19,564. (No model.)

To all whom it may concern:

Be it known that I, AUGUST KRASTIN, a citizen of the United States of America, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Fuel-Mixing and Charge-Controlling Apparatus for Hydrocarbon Explosive-Engines, of which the following is a specification.

My invention relates to improvements in means for controlling and mixing the charges of hydrocarbon explosive-engines; and the objects of my improvements are, first, to provide for an apparatus wherein a thorough mixture can be obtained and whereby variable charges maintain automatically a predetermined explosive mixture of fuel and air, and, second, to render said apparatus extremely simple in construction and manipulation and absolutely safe and reliable in point of operation. I attain these objects in an apparatus equipped and arranged substantially in the manner as shown in the accompanying drawings, in which—

Figure 1 represents a vertical sectional view of said mixing and liquid-feed controlling apparatus in connection with the cylinder and valves of an explosive-engine, and Fig. 2 illustrates a horizontal sectional view of same on line X X. (See Fig. 1.)

Like letters of reference denote like parts in the drawings and specification.

In the main said apparatus comprises a suitable casing A, which contains a suction-operated needle-valve B and a charge-regulating cock C. The air-receiving terminal *a* of said casing is preferably flaring and provided or covered with a wire-gauze *b*. The other extremity is adapted for connection with the main-valve casing, as indicated at *c*. In the drawings part of a horizontal cylinder is shown, as at *d*.

D indicates the main inlet-valve, and E the exhaust-valve, of an explosive-engine.

The charge-controlling cock C is placed intermediate the automatically-operated needle-valve B and the terminal adjacent the main inlet-valve. Said cock is adapted for either hand operation or automatic governor-regulation by means of the lever F. A cap G and spring H retain said cock in operative connection with the cone-sleeve *e* of said casing.

Fuel is supplied to the needle B by means of the pipe *f*, of which the branch *f'* is connected with a tank or the like. At or near the junction of *f* and *f'* is formed a seat for an auxiliary valve I, which is only closed upon stopping of the engine. The needle-valve proper has its seat at *g*. The upper terminal of said valve is cross-connected by member *h* to the guide *h'* of diaphragm *i*, which controls the passage in the casing, as at *j*. (See Fig. 1.) As shown, the valve or diaphragm *i* has no "seat" in the ordinary sense of the use of this word, the seat being formed by the annular flange of the restricted or contracted passage-way *j*, the valve being capable of passing entirely through said passage-way, as described. Hence there can be no coöperation between the valve and its seat, by means of which the closing movement of the valve can be stopped or limited. The stopping or limiting of this movement must therefore be accomplished by means other than the seat, and in the present invention this stopping or limiting of the movement is performed by the fluid-inlet valve through the medium of the connecting-bar *h*, which forms a positive connection between the stems of the valves B and *i*, as shown. It will be obvious that any movement of the valve *i* under the action of the spring *n* beyond the position shown in Fig. 1 (which is the closed position) will be positively prevented by the seating of the valve B, so that said valve B serves to position the valve *i* relative to its seat to close the air-inlet. While this positioning on the part of the valve B is necessary to accomplish the results accruing by reason of the movement of the valve *i* on its stem, as hereinafter pointed out, there is a particular advantage due to this construction, regardless of the movement of said valve *i* on its stem. This advantage lies in the fact that the movement of the two valves is necessarily in unison, so that the seating of one cannot be accomplished without the other being seated, and insuring, therefore, that the relative proportions of air and fluid are present in the mixing-chamber, there being no possibility of an increase of ratio of one over the other. Furthermore, by providing a cut-off valve for the air-inlet in place of a valve which coöperates with a seat, as in the usual constructions, the valves B and i can be given such positive connection as will allow them to operate in unison, a result difficult to accomplish where both valves have a positive seated position. Furthermore, the arrangement of the air-inlet and fluid-inlet valves out of axial alinement and positively connected together, as shown, is of advantage. Such construction allows the mixing-chamber to be given such form as to direct the incoming air directly into contact with the fluid as it issues from the inlet-ports, and thus tending to eliminate any liability of a dripping of the liquid, which dripping would be detrimental in that there would perhaps be a formation of hydrocarbon at non-desirable times. Where the inlets are arranged in axial alinement, it is difficult to so direct the air-current, and hence the carbureting takes place, not as the liquid issues from its ports, but subsequently thereto and after it has dripped from one position to another in a comparatively exposed position. In such case, where the valves are seated by the action of a spring when the charging has been discontinued, there is exposed a quantity of the liquid, which may effect a change of conditions to a point detrimental to the operation of the engine.

In the sleeve k transverse ports $l\,l$ are formed, through which the hydrocarbon fuel is drawn when the needle-valve is raised from off its seat, which is only the case during the suction action of the engine.

Upon the stem h' is formed a flange or collar h^2, between which and the sleeve m is interposed a spring n, which tends to hold the needle-valve onto its seat, thus preventing "fluttering" of same. In automobile-engines such safeguards are of especial importance. The diaphragm is only slidingly connected with the stem, and between said diaphragm and the outer collar h^3 is placed a second spring n' for a purpose as hereinafter referred to. Through the top or cover of the casing extends a set-screw o for control of the lift of guide h'.

Windows or glasses $p\,p$ are provided at each side of the needle-valve to enable observation of the moving parts within the casing. Said glasses are secured to the casing by means of the screw-threaded rings $q\,q$. (See Fig. 2.)

With this apparatus it is intended that an unobstructed suction action of the engine can and will withdraw, through the ports $l\,l$, the required volume of fuel to furnish with the influx of air a properly-proportioned explosive mixture. The ports $l\,l$ are therefore made just large enough to allow the escape of the fluid which passes the needle-valve when the latter is raised to the fullest possible extent. In setting the cock as shown or "wide open" it is presupposed that the suction action of the piston can and will effect a full charge for the engine-cylinder. In this and no other instance will the diaphragm and needle-valve be opened to their fullest or maximum extent. Less lift of the needle-valve will be effected upon throttling the influx of the air, which is accomplished by turning the cock C to one side or the other, whereby the port area through said cock becomes obstructed. In drawing a smaller quantity of air through the casing the former will therefore be supplied with proportionately less fluid fuel. Thus the charge always furnishes a proper mixture of air and fuel, even though the cylinder is not filled to its maximum capacity. In forming an edge-like contraction in the casing, as at j, and by selecting a comparatively very thin diaphragm no appreciable lift of the needle-valve can be effected ere the air is admitted past the diaphragm, and just as readily can prematurely-exploding charges escape past said diaphragm upon compression of the spring n'. In raising of the diaphragm the spring n becomes slightly compressed and the energy stored thereby assists in a quick closing of the needle-valve, which remains closed during compression, explosion, and discharge stroke of the engine. Should there be any premature or back explosions past the main inlet-valve, then the force of the gases acts upon the inner side of the diaphragm and compresses the spring n' sufficient to allow the gases to escape past the contraction j, whereby the force of the gases is broken and hammering of the needle-valve is prevented. The valve i may therefore be said to have a cushioned or yielding mounting on its stem in one direction, the cushioning means serving also to normally hold or retain said valve in a predetermined position on the stem.

In connection with vehicle-motors it is intended to adjust the lever F by hand, whereas in stationary motors said lever may be shifted from the engine-governor, and thus automatically regulate the speed of the engine simply by supplying full or partial charges to the cylinder.

What I claim, and desire to secure by Letters Patent, is—

1. In an explosive-engine, a mixing-chamber; a fluid-inlet thereto; an air-inlet, said air-inlet being located out of vertical alinement with and on a plane below said fluid-inlet, said air-inlet comprising a cage having a constricted passage-way leading into said chamber said passage-way passing the air in close juxtaposition to said fluid-inlet, whereby the fluid entering said chamber is at all times subjected to air-currents; a fluid-inlet valve; and an air-inlet valve connected positively to said fluid-inlet valve, and normally positioned within and adapted to normally close said constricted passage-way and having a movement, under the action of the engine, into and out of said chamber, whereby

both valves will be controlled in unison and the air and fluid admitted to said chamber in proportioned amount.

2. In an explosive-engine, a mixing-chamber; a fluid-inlet and valve therefor; an air-inlet cage located at one side and out of vertical alinement with said fluid-inlet valve, said cage having a constricted passage-way leading into said chamber, the continuation of the walls of said passage-way within said chamber directing the air-current across and in close contact to the fluid-inlet port or ports; and an air-inlet valve of a diameter to substantially fit and pass through said passage-way, said valve being positively connected to said fluid-inlet valve and having a movement into and out of said chamber to said passage-way, the fluid-inlet valve positioning said air-inlet valve in said passage-way.

3. In an explosive-engine, a mixing-chamber; a fluid-inlet and a valve therefor; an air-inlet cage located at one side of and out of vertical alinement with the fluid-inlet valve, said cage having a constricted passage-way leading into said chamber, the continuation of the walls of said passage-way within said chamber directing the air-current across and in close contact to the fluid-inlet port or ports; an air-inlet valve positively connected to said fluid-inlet valve and having a diameter to substantially fit and pass through said passage-way, said air-inlet valve having a movement into said chamber, due to the operation of the engine; and a spring for returning said valves to a closed position, said fluid-inlet valve positioning the air-inlet valve in said passage-way.

4. In an explosive-engine, a mixing-chamber; a fluid-inlet and a valve therefor; an air-inlet cage located at one side of and out of vertical alinement with the fluid-inlet valve and having a restricted passage-way leading into said chamber, the continuation of the walls of said passage-way within said chamber directing the air-current across and in close contact to the fluid-inlet port or ports; an air-inlet valve positively connected to and out of alinement with said fluid-inlet valve and having a diameter to substantially fit and pass through said passage-way, said air-inlet valve having a movement into said chamber, due to the operation of the engine; a spring for returning said valves to a closed position, said fluid-inlet valve positioning the air-inlet valve in said passage-way; and an adjustable stop for limiting the inward movement of said valves.

5. In an explosive-engine, a mixing-chamber; a fluid-inlet and a valve therefor; an air-inlet cage located at one side of and out of vertical alinement with the fluid-inlet valve and having a constricted passage-way leading into said chamber, the continuation of the walls of said passage-way within said chamber directing the air-current across and in close proximity to the fluid-inlet port or ports; an air-inlet valve positively connected to and out of alinement with said fluid-inlet valve and having a diameter to substantially fit and pass through said passage-way, said air-inlet valve having a movement into said chamber, due to the operation of the engine; a spring for returning said valves to a closed position, said fluid-inlet valve positioning the air-inlet valve in said passage-way; and an adjustable stop for limiting the inward movement of said valves, said stop being independent of and having no movement with said valves.

6. In a carbureting device, the combination with a mixing-chamber; of a constricted passage leading thereto; and an air-inlet valve in said passage freely movable in either direction toward and from said passage, whereby both air is supplied for the charge and any excess pressure in the mixing-chamber is automatically relieved.

7. In a carbureting device, the combination with a mixing-chamber; and a fluid-inlet and valve therefor located therein; of a constricted passage leading to said chamber; and an air-inlet valve in said passage freely movable in both directions toward and from said passage, said air-inlet valve being connected to and positioned by the fluid-inlet valve, whereby both air and fluid are supplied for the charge in proportioned amounts, and any excess pressure in the mixing-chamber is automatically relieved.

8. In an explosive-engine, a mixing-chamber; a fluid-inlet and a valve therefor; an air-inlet cage having a constricted passage-way; and an air-inlet valve having movement in one direction to admit air to the mixing-chamber and an independent cushioned movement in the other direction on its stem, said valve being positively connected to said fluid-inlet valve and being of a diameter to pass through said constricted opening or passage-way, said air-inlet valve being normally positioned in said passage-way by the fluid-inlet valve.

9. In an explosive-engine, a mixing-chamber; a fluid-inlet and a valve therefor; an air-inlet cage having a constricted passage-way; and an air-inlet valve having a movement in unison with the movement of the fluid-inlet valve into and out of said chamber to said passage-way, said fluid-inlet valve positioning said air-inlet in said passage-way, said air-inlet valve being independently movable to a position without the mixing-chamber under excessive pressure therein.

10. In an explosive-engine, a mixing-chamber; a fluid-inlet and a valve therefor; an air-inlet cage having a constricted passage-way; a valve-stem; an air-inlet valve slidingly mounted thereon, said valve having a diameter to pass through said passage-way and having a movement into and out of said chamber into said passage-way, the fluid-inlet valve positioning said air-inlet valve in the passage-way; and means for yieldingly holding said valve in a predetermined position, whereby an excess of pressure within said

chamber will cause said air-inlet valve to pass without the passage-way.

11. In an explosive-engine, a mixing-chamber; a fluid-inlet and a valve therefor; an air-inlet cage having a constricted passage-way; a valve-stem; an air-inlet valve slidingly mounted thereon, said valve having a diameter to pass through said passage-way and having a movement into and out of said chamber into said passage-way, the fluid-inlet valve positioning said air-inlet valve in the passage-way; and a spring for yieldingly holding said valve in a predetermined position on said stem, whereby under an excess of pressure within said chamber, said valve will be permitted to pass therewithout to relieve said pressure.

12. In explosive-engines the combination with the inlet-valve cage of a casing provided with a port-controlling cock, a sleeve connected with the fuel-supply port having side openings above the valve-seat, a needle-valve controlling the inlet to said sleeve, an auxiliary stem connected with said needle-valve and guided within said casing, a movable diaphragm upon said stem controlling a contracted passage within said casing, springs applied upon said stem, one for holding the needle-valve normally in closed position and the other for retaining the diaphragm in alinement with said contracted passage all constructed and arranged substantially as and for the purpose set forth.

In testimony whereof I affix my signature in presence of two witnesses.

AUGUST KRASTIN.

Witnesses:
BERNHARD F. EIBLER,
CHAS. G. F. VON W. EMERY.